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Arroyo Center
Research Note
ARMY RESEARCH DIVISION

Improved Inventory Policy Contributes to Equipment Readiness

When Army equipment fails, the speed with which maintainers can restore it to mission-ready condition depends critically on the availability of needed spare parts. As Army inventory managers decide which spare parts to stock in their deployable Supply Support Activities (SSAs), they must balance performance goals against cost and mobility constraints. On the one hand, a massive inventory could potentially fill a large proportion of customer demands; on the other hand, the cost and mobility constraints of such an inventory would be prohibitive. To manage the tradeoff, the Army has used an algorithm that tracks customer demands in order to compute which items and how many of each to stock.

Unfortunately, the Army's satisfaction with this algorithm diminished over time. Too often Army maintainers found that the parts they needed were not stocked locally, which could mean lengthy delays of days to months as parts were requested from other sources. Long customer wait times frequently resulted in longer repair cycle times. They could also increase workloads if maintainers chose to work around a problem by removing needed parts from other pieces of downed equipment. When no workaround was possible, repairs could not be completed until all needed parts had arrived, thus hurting equipment readiness. It became apparent that the algorithm was not well-suited to the kinds of demand patterns generated by the variable operational tempo of deployed Army units. Moreover, commercial developments in inventory management suggested that better performance could be achieved.

The Army's Deputy Chief of Staff for Logistics sponsored Velocity Management (VM) research at RAND Arroyo Center to develop a new algorithm for calculating inventory levels in SSAs. Known as dollar cost banding (DCB), the new algorithm has produced immediate and significant gains in performance at little or no additional inventory cost. Improved inventory performance means that customers spend less time waiting for parts. As a result, repairs can be completed more quickly, which translates into higher equipment readiness rates. The Army has moved quickly to approve the use of dollar cost banding as a policy option for setting inventory at retail supply points Armywide. It is currently in use at over 40 percent of SSAs and is in the process of being implemented at many more.

COST BANDING IMPROVES INVENTORY PERFORMANCE IN TWO WAYS

SSAs that have implemented dollar cost banding have seen immediate improvements in performance. The primary metric for inventory performance is fill rate: when a customer needs a spare part, how frequently does the inventory fill the request? The fill rate at an SSA depends both on the breadth of the inventory (Is the needed item stocked?) and its depth (Is the item available, or has the supply run out?) Improved local fill rates mean that fewer requests need to be referred to outside supply sources, thus reducing the number of delays. As shown in Figure 1, divisions using cost banding have seen a substantial increase in local fill rates. The aggregate fill rates for SSAs at the 82nd Airborne, 101st Air Assault, and 3rd Infantry divisions have all improved, in some cases by nearly 50 percent.

How has dollar cost banding brought about improved performance? First, the new algorithm has made it possible to expand the breadth of deployable inventories. Traditionally, Army SSAs used a "one-size-fits-all" approach for determining whether or not to stock a particular line. An item not currently stocked would need nine

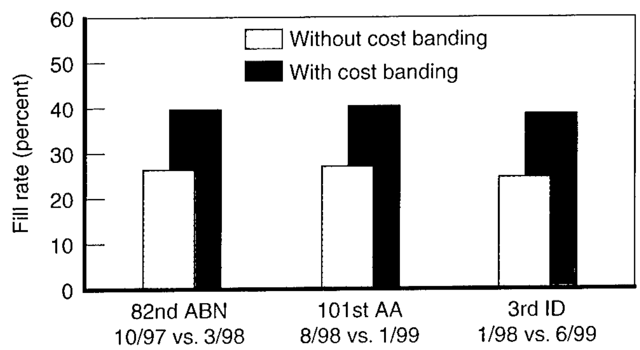

Figure 1. Fill Rates Have Improved Dramatically at Divisions that Have Implemented Dollar Cost Banding

requests in the prior year to be added, while an item already stocked would need three demands to be retained. These criteria were applied equally to a ten-cent screw and a $500,000 tank engine, despite the very different levels of investment associated with each item. In contrast, the dollar cost banding algorithm adjusts the criteria for determining whether an item should be added or retained according to the item's criticality, mobility requirements, end item density, and dollar value. It uses a two-year, rather than one-year, demand history. Under cost banding, a small, inexpensive, but mission-critical item might be added to inventory with only two demands and retained with just one. Cost banding has also automated the process for identifying nonessential, bulky items to be removed from deployable inventories.

Second, dollar cost banding allows for greater variation in the depth of stock for those lines that have qualified for inventory. The new approach abandons the Army's traditional but problematic "days-of-supply" algorithm for determining the quantity of each authorized item to stock. The traditional approach assumed that demands were distributed uniformly throughout the year and simply divided the annual number of demands for an item by 365 to derive an average daily demand rate. To provide "extra" stock, the algorithm computed a "safety level" of five days of supply.

This approach frequently resulted in stock shortages, particularly in cases of variable or highly clustered demands. It was unable to address two key challenges associated with stocking deployable SSAs:

- Some small, inexpensive, but critical items receive few annual demands.
- The highly variable operational tempo of deployable Army units can lead to sudden increases in demand (e.g., during training exercises).

Dollar cost banding addresses these challenges by increasing the likelihood that small, inexpensive, but mission-critical items will be available locally. Cost banding works by setting fill-rate-driven goals for each stocked item in terms of how many days the customer must wait to receive the item (customer wait time or CWT). Small, inexpensive, mission-critical items receive shorter CWT goals. The CWT goals are used to set appropriate stock levels. For example, to meet CWT goals, stock levels are adjusted for items that would incur long delays if not available locally. Dollar cost banding thus reduces the risk of stock shortages and provides greater flexibility to SSAs in setting depth levels that are appropriate both to customer demands and replenishment patterns.

COST BANDING IMPROVES SUPPLY PERFORMANCE DRAMATICALLY WITH LITTLE OR NO ADDITIONAL INVESTMENT

Those divisions implementing dollar cost banding have seen improved performance throughout their SSAs, including main, forward, and aviation support battalions. Figure 2 provides a more detailed version of the improvement in fill rates shown in Figure 1. Figure 2 displays fill rates before (light green) and after (dark green) cost banding for each division's SSAs. Expected future performance is represented by the white bars. As the figure shows, SSAs in the forward support battalions achieved particularly impressive levels of improvement, but all SSAs show improvement. The predicted future performance for the divisions illustrates the potential for even greater improvement, as SSAs become more and more responsive to customer needs.

As indicated by the multiple levels of improvement shown in Figure 2, dollar cost banding has allowed SSA managers to change their inventories in phases. This approach gave managers flexibility in shifting inventories by choosing to draw down or return unneeded items to obtain funds for acquiring new items. Managers were initially provided with five alternatives, representing different levels of investment, mobility, and performance. Most SSAs began with the least expensive alternative. The first time cost banding was implemented, therefore, the immediate effect was typically a significant increase in the number of critical low-dollar lines. To accommodate the increased breadth, SSAs reconfigured their warehouses and containers to use space more efficiently. Subsequent reviews using the cost banding algorithm resulted in further improvements in supply performance, which increasingly resulted in changes to more expensive items.

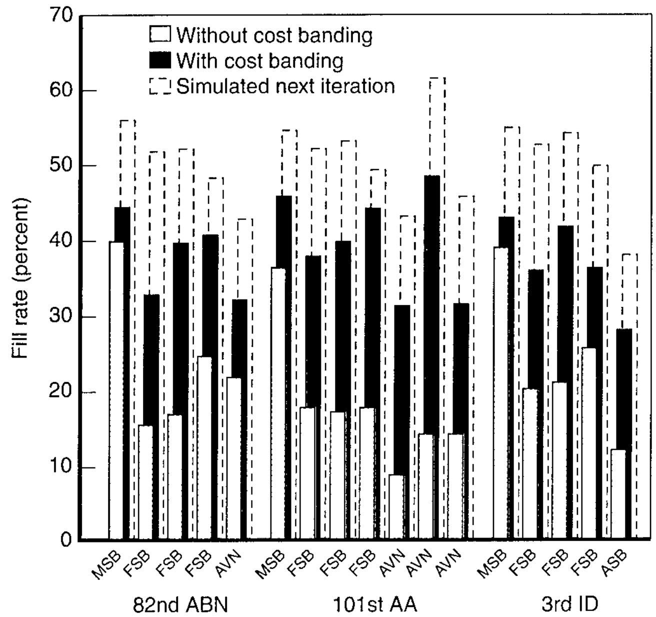

Figure 2. Dollar Cost Banding Particularly Improves the Performance of SSAs in Forward Support Battalions

Using this phased approach, divisions implementing dollar cost banding have achieved improved performance with little or no additional investment. The total weight and volume of inventories using cost banding have usually increased only marginally and in many cases declined, sometimes significantly. Much of the increase in breadth has taken place in lines costing less than $100, and many of these items are small, allowing SSAs to remain mobile. After implementing cost banding, the 82nd Airborne Division saw the value of its spare parts inventory rise from $9.5 million to $10.4 million, while the 101st Air Assault Division saw the total value of its spare parts inventory decline dramatically, from $20 million to $10.2 million.

THE ARMY IS IMPLEMENTING DOLLAR COST BANDING QUICKLY

Once a few pilot sites had demonstrated the dramatic effectiveness of cost banding, the Deputy Chief of Staff for Logistics approved it as a policy option for setting inventory at retail supply points Armywide. The Army has 149 spare parts supply warehouses serving customers on active duty, 127 of which are deployable. Over 40 percent of these sites have fully implemented cost banding, while another 50 percent are in the process of doing so.

The contrast in SSA performance for the Army divisions that have implemented cost banding and those that have not yet done so can be striking, as shown in Figure 3. On the left side of the figure are fill rates at six divisions whose SSAs have implemented dollar cost banding. On the right side of the figure are fill rates for four divisions that have yet to implement dollar cost banding, together with the estimated fill rates that might be achieved if the division shifted to the new algorithm. All four divisions show potential for dramatic improvement.

AS SSA FILL RATES RISE, CUSTOMER WAIT TIME FALLS

Higher local fill rates are beneficial in several ways. When parts orders can be filled from local stocks, maintainers typically receive their needed items on the same day or the next day, allowing repairs to be completed more quickly. In contrast, requests that must be referred to distribution centers, maintenance activities, or manufacturers can result in delays ranging from five to ten days to many months. The impact of such delays is multiplied when several parts are needed to complete each repair.

One important benefit of dollar cost banding is apparent in the improved CWT at Fort Knox. As one of the most recent Army installations to implement cost banding, Fort Knox offers the most complete data set currently available to track supply performance. Although the SSA at Fort Knox is not deployable, the fort's role as the site of the Army's tank training school means that its supply support needs are similar to those of deployable units. Fort Knox illustrates how improved local supply fill rates can affect CWT. With the shift to dollar cost banding, the fill rate at Fort Knox improved from 41 percent to 63 percent. During the same period, median CWT for high-

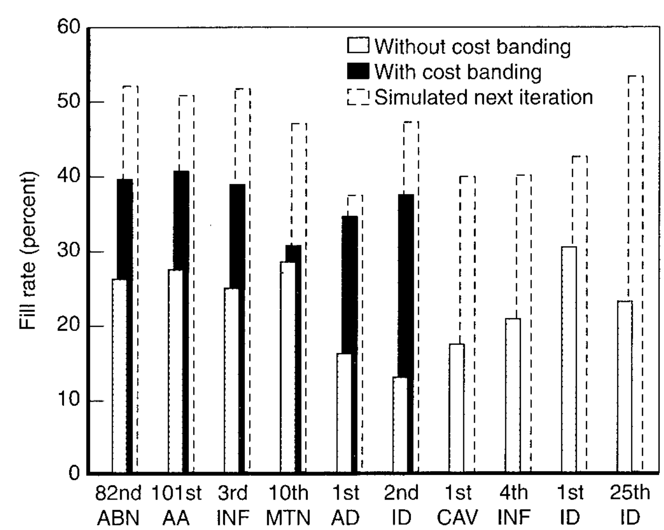

Figure 3. Fill Rates for Divisions With and Without Cost Banding

prority demands collapsed from 2–3 days to just 0–1 days. In other words, half the parts that maintainers order for the repair of downed equipment are now available immediately.

AS CUSTOMER WAIT TIME SPEEDS UP, SO DO REPAIRS

Improved local supply fill rates and reduced CWT have led to quicker tank repair times. One of the reasons for this improvement has been an increase in the percentage of repair jobs that could be completed with all locally available parts. When all parts needed for a job are stocked locally, repairs can be completed more quickly because no parts need to be ordered off-post. At Fort Knox, for example, the average repair time for jobs completed with all locally supplied parts was just three days, while jobs requiring at least one part from an outside source often averaged more than two weeks. After the implementation of cost banding, the percentage of jobs at Fort Knox that could be completed with all locally supplied parts rose from 21 to 28 percent—a 33 percent improvement.

Average tank repair times also went down because of a reduction in the number of parts that had to be supplied from nonlocal sources. At Fort Knox, the percentage of jobs requiring at least one part from a nonlocal source fell from 57 to 51 percent. In addition, many jobs that in the past would have required several referrals now could be completed with only one, thus reducing the total time spent awaiting parts. As shown in Figure 4, after the implementation of dollar cost banding, the average repair time for M1A1 tanks at Fort Knox decreased from 12.4 days to 8.8 days, a 29 percent decrease.

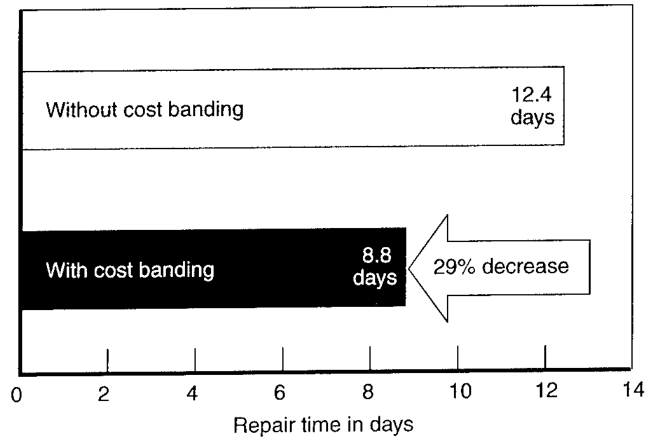

Figure 4. Repair Times Decreased at Fort Knox With Dollar Cost Banding

QUICKER REPAIRS HELP IMPROVE EQUIPMENT READINESS

The performance improvements provided by cost banding benefit soldiers both in garrison and during deployment. Improved repair times have a direct impact on equipment readiness. If repairs are completed quickly, equipment can be returned to mission capable status. For example, since the implementation of dollar cost banding at Fort Knox, the percentage of mission capable M1A1 tanks has risen from an average of 79 to 86 percent.

Dollar cost banding offers an opportunity for Army supply sources to make immediate and lasting improvements in filling customer orders. The new algorithm has been a critical component of the Army's effort to streamline and improve the responsiveness of its logistics processes. Velocity Management research at RAND continues to seek new opportunities for continuous improvement of Army supply performance.

This RAND research note summarizes recent results of Velocity Management (VM) research being carried out in the RAND Arroyo Center. Ken Girardini leads the research that developed dollar cost banding and provided analytic support for its implementation. Eric Peltz leads the research on diagnosing the drivers of equipment readiness. Further information on the application of VM to reduce CWT can be found in Accelerated Logistics: Streamlining the Army's Supply Chain, *by Mark Y.D. Wang, MR-1140-A, 2000, 48 pp., $20.00, ISBN: 0-8330-2785-9;* Velocity Management: An Approach for Improving the Responsiveness and Efficiency of Army Logistics Processes, *by John Dumond et al., DB-126-1-A, 1995, 50 pp., $6.00, ISBN: 0-8330-2268-7; and* Establishing a Baseline and Reporting Performance for the Order and Ship Processes, *by Kenneth J. Girardini et al., DB-173-A, 1996, 75 pp., $6.00, ISBN: 0-8330-2459-0. Questions or comments on VM research should be directed to John Dumond, director of Arroyo Center's Military Logistics Program. To order these documents or additional copies of this research note, contact RAND Distribution Services (Telephone: 310-451-7002; toll free 877-584-8642; FAX: 310-451-6915; or email: order@rand.org). Abstracts of RAND documents may be viewed at www.rand.org. Visit the Arroyo Center at www.rand.org/ard. Publications are distributed to the trade by NBN. RAND® is a registered trademark. RAND is a nonprofit institution that helps improve policy and decision-making through research and analysis; its publications do not necessarily reflect the opinions or policies of its research sponsors.*

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